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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/724,938	12/01/2003	Yu-Ting Cheng	YOR920030286US1(8728-659)	3222

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EXAMINER	
HA, NATHAN W	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 12/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/724,938	CHENG ET AL.	
	Examiner	Art Unit	
	Nathan W. Ha	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) *1-11* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *12-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I in the reply filed on 10/11/05 is acknowledged. The traversal is on the ground(s) that there is a common search for all of the indicated inventions. This is not found persuasive because the non-elected invention, claims 1-11 is classified in a different class, class 257. The elected invention is classified in class 438. Therefore, the search for these two sub-classes are indeed not co-extensive.

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 22 recites the limitation "lead-free solder ball" in line 2. There is insufficient antecedent basis for this limitation in the claim. Is this limitation is the same as "solder ball" recited in claim 12?

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 12-15, 17, 19, and 21-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brintzinger (US 2003/0127743) in view of Jin et al. (US 2004/0178503, hereinafter, Jin.)

In regard to claims 12 and 23, in figs. 1-6, Brintzinger discloses a method for forming an interconnection structure for flip-chip attachment of microelectronic device chips to packages, comprising:

forming a barrier layer 2 over a substrate 1;

forming an adhesion layer 3 over the barrier layer;

forming a resist layer 7 over the adhesion layer, the resist layer having an opening that exposes the adhesion layer;

forming first solderable layer 4 over the adhesion layer through the opening the resist layer;

forming a diffusion barrier layer 5 over the first solderable layer through the opening the resist layer;

forming a second solderable layer 6 over the barrier layer through the opening in the resist layer, fig. 6 shows this feature;

removing portions of the barrier layer and the adhesion layer that extend beyond the first solderable layer, the diffusion layer and the second solderable layer.

Brintzinger further discusses the feature of the solderable layer 6 such for layer conductive bump can be formed thereon. However, he does not expressly show a solder ball is formed on the solderable layer. As clearly define by Brintzinger in

paragraph [0034], solder bump is a must have conductor to make electrical connection to external devices. It is common in semiconductor package due to the availability and widely used of solder. For instance, Jin is incorporated herein to show the obviousness and well known of a solder ball which provides electrical connections between devices. Jin, in figs. 6-9, discloses an analogous UBM structure with layers and further a solder bump 36 is formed on solderable layer 32 in order to complete from a connection structure wherein the bump is directly connected to outside devices.

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of the invention was made to further recognize that a conductive solder element may be formed on a solderable as mentioned by Brintzinger and the conductive maybe formed as a solder bump as taught by Jin in order to take the advantage as mentioned above.

In regard to claims 13 and 28, Brintzinger discloses photoresist layer is formed around the barrier layer, the adhesion layer, the first and second solderable layers and the diffusion barrier layer. Photoresist material is a form of polyimide material.

In regard to claim 14, Brintzinger further discloses that the step forming the barrier layer comprises sputtering. See paragraph [0029].

In regard to claim 15, Brintzinger further discloses wherein the step of forming the adhesion layer comprises sputtering. See paragraph [0029].

In regard to claims 17 and 25, Brintzinger further discloses that the step of forming the diffusion barrier layer comprises electroless deposition. See the discussions in paragraphs [0033-0034].

In regard to claim 19, Brintzinger further discloses that the first solderable layer is made of Cu. See [0029].

In regard to claim 24, Brintzinger discloses all of the limitations as mentioned in claims 1 and 23 above and further discloses a method of electrolytic the adhesive layer. See [0029].

In regard to claim 27, Brintzinger further discloses

removing the resist layer after the first solderable layer, the diffusion barrier layer and the second solderable layer are formed; and

removing portions of the barrier layer and the adhesion layer that extend beyond the first solderable layer, the diffusion barrier layer and the second solderable layer after the resist layer is removed. See figs. 6-7.

In regard to claim 21, Jin discloses that the barrier can be formed by Ni in order to provide wettable feature which facilitates the process of from the solder bump to the layer. See [0093].

Therefore, it would have been obvious to one of ordinary skilled in the art to substitute the barrier layer as taught by Jin in Brintzinger's in order to take the advantage as mentioned above.

In regard to claim 22, and with the 112 rejection above, Jin further discloses that the solder ball is formed by solder screening, or printing. This method results in a solder bump height. See [0040].

Therefore, it would have been obvious to one of ordinary skilled in the art to substitute use the method as taught by Jin in Brintzinger's in order to take the advantage as mentioned above.

6. Claims 16, 18, 20, 26, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brintzinger and Jin as applied to claims 12-15, 17, and 21-28 above, and further in view of Barth et al. (US 6,730,982, hereinafter, Barth.)

In regard to claims 16, 18 and 26, the above combination does not expressly disclose that the solderable layer, metal, is made by electroplating method.

Barth, in fig. 1, for example, discloses a metallization structure including the copper layer, or diffusion barrier layer, made of electroplating in order to control the thickness of the layer. See col. 3, lines 53-54.

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of the invention was made to use the well known method such electroplating in order to control the thickness of the barrier layer.

In regard to claims 20 and 29, Barth further discloses that the diffusion is made of CoWP as a cap layer. See col. 4, lines 10-13.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan W. Ha whose telephone number is (571) 272-1707. The examiner can normally be reached on M-TH 8:00-7:00(EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nathan Ha
December 5, 2005